

# NEWS REPORT

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NATIONAL RESEARCH COUNCIL



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*Editorial Office:* 2101 Constitution Ave., Washington 25, D. C.

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# NEWS REPORT

*National Academy of Sciences      National Research Council*

VOLUME VII

November-December 1957

NUMBER 6

## Highway Research and the Expanded Highway Construction Program<sup>1</sup>

K. B. WOOD, *Chairman*

*National Advisory Committee for the AASHO Road Test*

**I**N DEVELOPING an adequate highway system within the next 15 years at a cost of about \$100 billion, the United States will draw heavily upon the economic resources of the nation. It is obvious that to plan, design, construct, operate, and maintain the vast highway system will require economical and efficient use of manpower, materials, machinery, and equipment as well as the development and utilization of new methods and techniques in all phases of highway development. It is equally obvious that an effective research program must be conducted to provide solutions to the many unsolved problems, to improve present solutions, and to facilitate development of the highway program.

Congress, in recognizing deficiencies in the highway construction program, contributed significantly to financing the program. In addition, the U.S. Bureau of Public Roads was given a mandate by Congress to conduct research studies in areas where problems urgently need solutions.

Research in highway transportation is not of recent origin in the United States. The construction of the Cumberland Road,

roughly from 1806 to 1844, the development of activities within the Office of Road Inquiry and later within the U. S. Bureau of Public Roads, the Bates Road Test in Illinois in 1920-21, the investigations of the Federal Coordinator of Transportation and of the Board of Investigation and Research in the 1940's, various studies by the several states and universities, and the recent work under the direction of the Highway Research Board of the Academy-Research Council, represent research programs in various areas of highway transportation. Each has contributed to the fund of knowledge.

The Highway Research Board through its several departments and committees has been actively engaged in promoting and conducting research in a great many areas. The development of the test-road method of conducting highway research has received considerable attention from the Board in recent years. In general, these tests have been concerned with the economics of highway design and operation and may contribute significantly to how highway costs might be assigned equitably to the users and beneficiaries of highways.

It is the purpose of this paper to dis-

<sup>1</sup> Condensed from the presentation at the annual meeting of the Division of Engineering and Industrial Research, Academy-Research Council, May 20, 1957.

cuss very briefly the American Association of State Highway Officials (AASHO) Road Test under way in northern Illinois and the greatly accelerated highway construction program. The need for the road test and the relationship of the research findings to the new construction require some consideration. Likewise, the role of the Academy-Research Council's Highway Research Board in these two enterprises is a subject of considerable significance. The full impact of the new construction program and of the finished roads themselves can only be estimated, yet this subject is of utmost importance to the entire nation.

#### Field Road Tests

The first field road test since World War II was located in Maryland and is known as Road Test One-Md. The results, published in 1952, have led to additional research and a much better understanding of the reasons for failures in pavements. The second project, located near Malad, Idaho, is known as the Western Association of State Highway Officials (WASHO) Road Test. The results were published in 1954.

The third field project, now in progress, is the AASHO Road Test, located between LaSalle and Ottawa, Ill., about 80 miles southwest of Chicago. These three large field tests have been conducted by the Highway Research Board in cooperation with the U. S. Bureau of Public Roads, many of the states, and interested industries.

The objectives of the AASHO Road Test are briefly as follows:

- 1) To determine the significant relationships between the number of repetitions of specified axle loads of different magnitude and arrangement and the performance of different thicknesses of uniformity designed and constructed asphaltic concrete, plain portland cement concrete, and reinforced portland cement concrete surfaces on different thicknesses of bases and subbases when on a basement soil of known characteristics.

- 2) To determine the significant effects of specified vehicle axle loads and gross vehicle loads when applied at known frequency on bridges of known design and characteristics. The bridges will include steel I-beam design, conventional reinforced concrete design, and prestressed concrete design.

- 3) To make special studies dealing with such subjects as paved shoulders, base types, pavement fatigue, tire size and pressures, and heavy military vehicles, and to correlate the findings of these special studies with the results of the basic research.

- 4) To provide a record of the type and extent of effort and materials required to keep each of the test sections or portions thereof in a satisfactory condition until discontinued for test purposes.

- 5) To develop instrumentation, test procedures, data, charts, graphs, and formulas, which will reflect the capabilities of the various test sections; and which will be helpful in future highway design, in the evaluation of the load-carrying capabilities of existing highways, and in determining the most promising areas for further highway research.

In June 1956, Congress passed new highway legislation directing the Secretary of Commerce

... to take all action possible to expedite the conduct of a series of tests now planned or being conducted by the Highway Research Board of the National Academy of Sciences, in cooperation with the Bureau of Public Roads, the several states, and other persons and organizations, for the purpose of determining the maximum desirable dimensions and weights for vehicles operated on the Federal-Aid highway systems, including the Interstate System, and, after the conclusion of such tests, but not later than March 1, 1959, to make recommendations to the Congress with respect to such maximum desirable dimensions and weights.

This most recent test road contains four basic loops including dual straightaways of 6,600 feet with a turn around at each end. Two smaller test loops are being constructed, one of which will not be subjected to test traffic. Construction of all test sections is scheduled for completion by the summer of 1958. Rigid and flexible pavements of controlled cross-section design are being placed on bases and subbases of specified depth. These pavements will be subjected to controlled traffic. Extreme care in locating the test sections in an area of uniform soils, supplemented by good construction practices and control techniques, has made possible the building of uniform embankments and subgrades for the placing of bases and subbases. The test pavements will undergo axle loadings ranging from 2,000 to 30,000 pounds on single axles and from 24,000 to 48,000 pounds on tandem axles, 16 hours a day, 6 days a week for 2 years.

TABLE 1.—Summary of AASHO Road Test design and testing features.<sup>1</sup>

ITEM	LOOP A	LOOP D	LOOP C	LOOP E	LOOP F	LOOP B
Test axle loadings:	12,000-lb. single 24,000-lb. tandem	30,000-lb. single 48,000-lb. tandem	22,400-lb. single 40,000-lb. tandem	2,000-lb. single 6,000-lb. single	No traffic  Strain test traffic <sup>2</sup>	18,000-lb. single 32,000-lb. tandem
Rigid Pavement: No. of test sections...	68	68	68	40	56	68
Concrete slab thick- nesses in inches.....	3.5, 5.0, 6.5, and 8.0	8.0, 9.5, 11.0, and 12.5	6.5, 8.0, 9.5, and 11.0	2.5, 3.5, and 5.0	2.5, 5.0, 9.5, and 12.5	5.0, 6.5, 8.0, and 9.5
Subbase thicknesses in inches.....	0, 3, 6, and 9	0, 3, 6, and 9	0, 3, 6, and 9	0, 3, and 6	0 and 6	0, 3, 6, and 9
Flexible Pavements: No. of test sections...	84	84	84	68	64	84
Asphalt concrete sur- facing thicknesses in inches.....	2, 3, and 4	4, 5, and 6	3, 4, and 5	0, <sup>3</sup> 1, 2, and 3	1, 3, and 5	3, 4, and 5
Base thicknesses in inches.....	0, 3, and 6	3, 6, and 9	3, 6, and 9	0, 3, and 6	0 and 6	0, 3, and 6
Subbase thicknesses in inches.....	0, 4, and 8	8, 12, and 16	4, 8, and 12	0 and 4	0, 8, and 16	4, 8, and 12

<sup>1</sup> Special sections to study effects of paved shoulders, base type, etc., not shown.<sup>2</sup> Traffic only to determine structural changes in the materials because of weathering, aging, etc.<sup>3</sup> Surface treatment.

Table 1 presents a summary of the design and testing features of this project, estimated to cost about \$22,000,000.

The project is located in an area which is reasonably representative of the soils and climatic conditions of the Midwest, the northern tier of states, and some parts of southern Canada. Correlation tests and interpolation will be required to use the research data for design purposes in the warmer, sandy-soil areas of the Gulf and Eastern Coastal Plains, for many sections of the arid and semiarid regions of the West, and for the well-drained soil areas of New England.

In summary, the AASHO Road Test is not an ordinary test. The experiments have been designed with the best engineering and statistical procedures available. The research data are to be collected through elaborate instrumentation being developed by a competent staff with the cooperation and advice of highly skilled specialists. Measurements have been or will be made for control of construction, of the relationships between the behavior of the various pavement and bridge designs

and the various loadings, and of those phenomena that will help explain how pavement and bridge failures develop. Because voluminous data will be accumulated throughout this project, only data that will best serve a specific purpose are being recorded, and the most modern techniques in data accumulation and data reduction will be used. Wherever appropriate, high-speed electronic digital computers will be used for analysis. The final results are expected to provide much valuable information for use in the development of a more efficient and economical road network in the United States.

#### Some Research Aspects of the New National Road Program

The Federal Aid Highway Act of 1956 is another major factor in the promotion of the development of a more efficient and economical road system. The huge 13-to-15-year program for a 41,000-mile national system of interstate and defense highways linking 209 cities of 50,000 population or more was authorized by the act. Additional money was also appropriated for the

present federal-aid systems as well as national park and Indian reservation roads.

Along with the authorization of the expenditure of funds, Congress delegated responsibility to the U. S. Bureau of Public Roads for administering the program under the direction of a newly appointed Federal Highway Administrator. The states, however, will prepare the plans and let the contracts for the actual construction in co-operation with the Bureau of Public Roads. Congress included in this delegation of responsibility to the Bureau of Public Roads a mandate covering the investigation of five specified problem areas: *a*) estimates of cost of the new interstate system for apportionment of funds to the several states, *b*) appraisal of roads already constructed if included in the system, *c*) incremental costs of building roads to meet the demands of various classes and types of users, *d*) the maximum desirable sizes and weights of road vehicles, and *e*) safety promotion through better road design and construction. Research will be required particularly for the last three problem areas.

#### Impact of the New National Road Program

The impact of the new national road program—especially the interstate system—on the economy and development of this nation will be far-reaching, but at present can only be estimated.

The growth and development of urban areas will be greatly affected by the new interstate system as more than one-half of the interstate funds will be spent for radial and circumferential routes in metropolitan areas. These new routes will influence the growth pattern in these areas and will make suburban living even more attractive.

Interstate routes also will stimulate the growth of new industrial and residential areas between metropolitan areas. Although the New York Thruway has not been open to traffic very long, it is conservatively estimated that more than \$150 million have been expended on the construction of new industrial plants along the route. Overlapping metropolitan areas and rapid growth will create additional

problems which need study. Changing patterns of living will result in urban areas oriented to highways instead of to rivers and harbors as in the past. Where will the new areas obtain water and suitable facilities for disposal of wastes? Will these new areas be properly planned with parks, schools, shopping centers, industrial developments, cultural facilities, and all the other things that make a community a good place to live? Will public transit be abandoned or will public transit operations become shuttle service from outlying parking areas to downtown central business districts? Will the growth of urban aggregates along highways in fertile farmland areas seriously deplete our supply of agricultural land?

By 1970 all highways of the United States will occupy 17 million acres of land (nearly 1/10 acre per capita), including about 1½ million acres for the 41,000 miles of the new interstate highway system. This amounts to more than 2,000 square miles of land (Rhode Island has an area of 1,214 square miles). Because this new system will consist mostly of limited access on new right-of-way, much non-highway land will be required.

One of the outstanding legal and political problems resulting from the new highway program is that of advance acquisition of right-of-way. In addition, one of the great unknowns in the new program is the future status of mass transportation. The current trend in decreased use of mass transit by the public could well be accentuated by the new program, yet proper planning of the highway systems in and about larger cities could facilitate the use of express buses and thereby aid commuting at the same time reducing the need for off-street parking in downtown areas.

There are no foreseeable major changes to be made in the over-all road design concept, except those which may result from research findings such as those from the AASHO Road Test. On the other hand, the new road system will stimulate more research in geometric design and operation, new interchange designs, and frontage road treatments. Radar for vehicle control and traffic surveillance, new concepts



of illumination for night driving, new methods for snow and ice removal, and electronic controls for operating metropolitan freeway systems may well be in use in the years ahead. Certainly, safety to the motorist will be uppermost in the minds of the designers and every effort will be made to produce a road which is interesting, safe, and efficient for the American motorist.

The immediate economic impact on the nation will be far-reaching. While the Romans required 500 years to build the 50,000 miles of their famous single-lane highway system, the 41,000 miles of the interstate system probably will be built in about 15 years. The program will be of great economic significance for our resources and for industries other than those concerned with road construction. The U. S. Bureau of Public Roads has estimated that 49 million tons of steel, 1,339 million barrels of cement, 128 million tons of bituminous material, 9,710 million tons of aggregate, and large quantities of other construction materials will be needed in the highway construction program. Most of these materials will be used for the interstate system.

Manpower is also needed. One of the most critical problems of the new program

is a shortage of civil engineers. This shortage is already being reflected in increased college enrollment in the field of civil engineering and in increased salaries for civil engineers.

#### Highway Research Board

There can be no question about the impact of the new highway program in stimulating research. There is an indication of a closer relationship between the road designer and the automotive engineer. It is entirely possible that a new concept of a road-car combination will be evolved before the entire program is completed.

The far-reaching results of a Highway Research Board's efforts in the highway research field are well demonstrated in the conduct of the three road tests, especially in connection with the AASHO project previously described. However, the work of the Board is much broader than is indicated by the field test projects alone. Work in such fields as traffic and operations, urban planning, economics, finance, and administration is expanding rapidly, but not at the expense of the work in the well-established fields, such as soils, materials, maintenance, and design.

## Twelfth General Assembly of International Scientific Radio Union

J. HOWARD DELLINGER

*Chairman, General Arrangements Committee*

THE TWELFTH General Assembly of the International Scientific Radio Union (URSI) was held in Boulder, Colo., August 22-September 5, under the sponsorship of the National Academy of Sciences-National Research Council. Local hosts for this international gathering were the University of Colorado, the Boulder Laboratory of the National Bureau of Standards, the High Altitude Laboratory, and the City of Boulder. Financial support was provided

by contributions from 86 commercial organizations and government agencies.

Although general assemblies are held every three years, this is the first time the Union has convened in the United States since 1927. More than 850 participants representing 22 of the 25 member countries attended the sessions. Of these, 300 came from outside the United States. Austria, Greece, and the U.S.S.R. were formally admitted to the Union at this Gen-

eral Assembly; and Argentina, a non-member, was represented by observers.

The official United States delegation to the General Assembly was composed of the following members:

HARRY W. WELLS, Carnegie Institution of Washington, *Chairman*

WILLIAM E. GORDON, Cornell University

JOHN P. HAGEN, U. S. Naval Research Laboratory

M. G. MORGAN, Dartmouth College

A. H. WAYNICK, Pennsylvania State University

The technical sessions revolved around the work of the following seven Commissions of the Union: I—Radio Measurement Methods and Standards; II—Tropospheric Radio Propagation; III—Ionospheric Radio Propagation; IV—Radio Noise of Terrestrial Origin; V—Radio Astronomy; VI—Radio Waves and Circuits; and VII—Radio Electronics. Each commission met about six times. Some of the symposia were joint sessions of two or more commissions. The joint symposia which drew the largest attendance were those on radio astronomy and masers.

Tuesday, August 27, was devoted entirely to the International Geophysical Year (IGY). Sir Edward V. Appleton, Nobel Prize winner and chairman of the URSI Committee for the IGY, presided. Plans to intensify the worldwide radio and ionospheric work during the IGY were perfected and special attention was given to Ursigrams, the coded messages of cosmic data disseminated by radio and wire systems throughout the world.

In honor of the part played by the Union in initiating the plan to have an international geophysical year, the cosmos itself saluted the General Assembly with three ionospheric storms, which required the declaration of a Special World Interval for concentrated worldwide observations. When the delegates left the closing banquet they saw a brilliant aurora, an exceedingly rare spectacle at Boulder.

The Executive Committee of the Union made a number of advances in the organizational planning for the future. In addition to the triennial assemblies, the Union will promote international symposia on specific subjects of interest to one or more of the Commissions. Definite arrangements

for planning and conducting such symposia were made.

Among the actions of the General Assembly was a modification of the scale of contributions made by the various member countries in support of the Union. Under the new schedule the maximum annual subscription to the Union from any one country was set at \$4,000.

The Union decided to hold the next General Assembly in Great Britain in 1960 and elected the following officers to serve for the period 1957-60:

SIR EDWARD V. APPLETON (Great Britain), *Honorary President*

R. BUREAU (France), *Honorary President*

J. HOWARD DELLINGER (United States), *Honorary President*

W. H. ECCLES (Great Britain), *Honorary President*

E. H. RAYNER (Great Britain), *Honorary President*

B. VAN DER POL (Netherlands), *Honorary President*

LLOYD V. BERKNER (United States), *President*

I. KOGA (Japan), *Vice-President*

R. L. SMITH-ROSE (Great Britain), *Vice-President*

G. A. WOONTON (Canada), *Vice-President*

C. H. MANNEBACK (Belgium), *Treasurer*

E. HERBAYS (Belgium), *Secretary-General*

The chairmen of the seven international Commissions of the Union for the same period are:

B. DECAUX (France), *Commission I*

R. L. SMITH-ROSE (Great Britain), *Commission II*

D. F. MARTYN (Australia), *Commission III*

ROBERT A. HELLIWELL (United States), *Commission IV*

A. C. B. LOVELL (Great Britain), *Commission V*

S. SILVER (United States), *Commission VI*

W. G. SHEPHERD (United States), *Commission VII*

The administrative record and summaries of the technical discussions, lists of papers presented, etc., will appear in a set of eight pamphlets to be published by the Secretary-General of the Union. The technical papers will be printed in the Proceedings of the Institute of Radio Engineers, published in New York City. Further information about the publication program may be obtained from the Secretary of the U. S. National Committee of URSI.

Holding the General Assembly in a small city in the interior of the country permitted the local hosts to provide an unusually full program of special events. Besides recep-



tions and musicales, there were excursions to Colorado Springs, Pikes Peak, Estes National Park, and Central City. Entertainment included a rodeo, a chuck wagon dinner, and an exhibition of Indian dances. Arrangements were made for participants to visit the Cryogenic Laboratory and the Central Radio Propagation Laboratory of the National Bureau of Standards in Boulder, as well as the installations at Echo Lake, Cheyenne Mountain, Gun Barrel Hill, and Table Mesa. Several hundred members also went to the High Altitude Observatory at Climax, Colo. A complete program of entertainment was also planned for the wives and children accompanying the delegates. After the General Assembly there were optional tours to Rocky Mountain and Yellowstone National Parks and to Grand Canyon.

The Conference was pervaded with a remarkable spirit of solidarity and satisfaction. This is a time of rapid growth and almost explosive progress in radio research and applications. The specialists present from all over the world enjoyed the opportunity to discuss latest developments with one another, and the new sense of per-

sonal acquaintance, acquired in an environment of peace and beauty, will have a lasting effect on the future collaboration of the members of URSI.

In concluding this very brief account of the Boulder General Assembly, it is only fitting that the fine work of the General Arrangements Committee not only before, but also during the General Assembly, be acknowledged. The author takes this opportunity to thank the following members of the committee for their cooperation and expert handling of special assignments:

- L. V. BERKNER, President of Associated Universities, Inc., *Finance*
- K. A. NORTON and A. H. SHAPLEY, National Bureau of Standards, Boulder Laboratories, *Local arrangements*
- WILLIAM E. GORDON, Cornell University, and H. W. WELLS, Carnegie Institution of Washington, *Foreign arrangements*
- A. H. WAYNICK, Pennsylvania State University, and F. H. DICKSON, U. S. Army Signal Corps, *Technical program*
- MRS. K. A. NORTON, Boulder, Colo., *Ladies program*
- F. W. BROWN, Director, Boulder Laboratories, National Bureau of Standards; and QUIGG NEWTON, President, University of Colorado; *Honorary members*

## SCIENCE NEWS

### VISIT OF PRINCE PHILIP

His Royal Highness, the Prince Philip, Duke of Edinburgh, paid a visit to the Academy on Friday morning, October 18. Earlier, responding to President Bronk's invitation, Prince Philip had expressed his pleasure at the opportunity to engage in informal discussion of scientific matters during the state visit to Washington of Queen Elizabeth II. It was the Prince's second visit to the Academy, the previous occasion having been in 1951 when he came as the Duke of Edinburgh.

Because of the Prince's keen interest in the International Geophysical Year (IGY), several leaders of the United States programs related to the IGY were gathered to meet with him. A number of scientists of the Washington community were present as well, together with scientific and

other attachés of several of the Commonwealth embassies.

Prince Philip's party was greeted by President Bronk in company with Alan T. Waterman, Director of the National Science Foundation, Hugh L. Dryden, Home Secretary, and William J. Robbins, Treasurer of the Academy. The others of the group were presented to him by President Bronk in the Lecture Room where a number of exhibits of equipment related to the IGY programs of the United States were assembled. After careful study of each exhibit, the Prince sat down with the entire group and engaged in a lively discussion of a broad range of topics of current scientific interest.

At the end of his visit, the Prince inscribed his name for the second time in the Academy's foreign guest book, his signature having inaugurated the book in 1951.

## ATOMS FOR PEACE AWARD

The first Atoms for Peace Award was presented to Professor Niels Bohr on October 24 in a ceremony in the Great Hall of the Academy in which the President of the United States took part.

Established in 1955 by the Ford Motor Company, the annual Atoms for Peace Award is designed to honor those who have made especially distinguished contributions to the utilization of atomic energy for peaceful purposes. It consists of a medal and an honorarium of \$75,000. The awards are administered by a Board of Trustees, of which President Bronk is a member. Chairman of the Board is James R. Killian, President of the Massachusetts Institute of Technology and now special assistant to President Eisenhower on science and technology.

While the Academy as such has no responsibility for the administration of the awards, the Trustees determined that it would be especially fitting if the first award were presented at the Academy. A luncheon in honor of Professor Bohr, given by the President and Council of the Academy, preceded the presentation ceremony. Besides Professor Bohr the guests from abroad at the luncheon included Mrs. Niels Bohr, Mr. and Mrs. Ernest Bohr, son and daughter-in-law of the guest of honor, and the Ambassador of Denmark and Mrs. de Kauffmann.

More than three hundred were present in the Great Hall for the presentation ceremony, including many who had studied with Professor Bohr in Copenhagen or elsewhere during his long career of distinguished contributions to science. On the platform with Professor Bohr and Dr. Killian, who presided, were President Eisenhower, Detlev W. Bronk, President of the Academy, William C. Ford of the Ford Motor Company, John A. Wheeler of Princeton University, and Arthur H. Compton of Washington University.

After Mr. Ford's opening remarks on the purposes for which the awards had been established, Professor Wheeler described from long personal association the great scientific and human stature of Professor Bohr. Dr. Killian then made the presenta-

tion and Professor Bohr responded with a gracious expression of his appreciation of the honor done to him.

President Eisenhower addressed the audience on the debt that we owe to men of the rare genius of Professor Bohr and on the challenge with which we are confronted by the enormous scientific advances in which he has played such a distinguished part. The President noted especially the responsibility that devolves upon each of us, under God, to find the deep changes in the hearts of men that will enable all mankind to follow the path of constructive rather than destructive use of the enormous physical forces that science makes available to us.

Professor Compton closed the program with an address on "Science and the Growth of Man," in which he pointed to the urgent need for nations of advanced scientific development to bring science to the service of the benefit of mankind around the world.

A reception followed during which there was opportunity for the guests to meet Professor Bohr and for him to renew many old acquaintanceships at leisure.

## CALCULUS ON COLOR TELEVISION

The Advisory Board on Education is sponsoring an experimental course in calculus on color television for inservice high school teachers of mathematics and science in the Washington area. The Walter Reed Army Medical Center, the University of Maryland, and the American Association for the Advancement of Science are cooperating in the preparation and presentation of the course. The University of Maryland will give three hours of graduate credit to teachers who complete the entire course of twenty-six lectures.

Through a grant from the Ford Foundation the excellent color television facilities of the Army Medical Center will be used to make color kinescopes of the entire course. The kinescope made of these lectures will greatly enhance the experimental value of the course by affording an opportunity for comparison of various techniques and student responses.

#### LECTURE BY KEITH EDWARD BULLEN

The Academy-Research Council lecture series opened its 1957-58 season with an address by Keith Edward Bullen, Professor of Applied Mathematics at the University of Sydney, Australia, on November 12. Dr. Bullen spoke on "Earthquakes and the Deep Interior of the Earth."

The study of earthquakes, according to Dr. Bullen, provides valuable information about the deep interior of the earth. There are two types of waves which travel from an earthquake downward into the earth—primary or *P* waves which are longitudinal and *S* or secondary waves which are transverse. Since fluids do not transmit *S* waves noticeably, failure to detect these waves is evidence that the part of the earth concerned is in a fluid state. One of the early triumphs of seismology was the discovery and precise location of a central fluid core with a radius of about 2,200 miles. The solid mantle outside the core is made up of about five layers, detectable by their differing *S* and *P* wave velocities.

It was first thought that the central core was of uniform composition; but in 1936, Miss I. Lehmann, a Danish seismologist, discovered an inner core of 800 miles radius inside the central core. Supporting evidence has been provided by an analysis of seismic wave records from the four United States H-bomb explosions of 1954.

The *P* and *S* wave velocities are largely dependent on density, compressibility, and rigidity. By using this dependence and other data some of the physical properties of the earth's interior core can be determined. The specific gravity of the earth's mantle varies from that of surface rocks at the top to 5½ at the bottom. In the fluid core there is a steady increase downward in specific gravity from 9½ to 12. At the center of the inner core the value for specific gravity probably lies between 14½ and 18.

The rigidity of the inner core is calculated to be that of steel at ordinary pressures and temperatures. At the bottom of the mantle, the pressure is one and one-third million atmospheres and at the center of the earth it is nearly four million. The value for the acceleration due to gravity

stays within 2 percent of the surface value to a depth of 1,500 miles. It then rises a little until the bottom of the mantle is reached where it drops steadily to zero at the earth's center.

Nuclear explosions resemble earthquakes in that they, too, send seismic waves into the earth's interior. Although the energy in these waves is much less than that in natural earthquakes, their source, location, and time of origin can be precisely known. Although, in the past, advance information of the time of firing has not been available to seismologists, the Atomic Energy Commission did provide such information on the September 19 underground Nevada explosion, whose records will give important information on the outer part of the earth below the Western United States. Seismologists hope that in the future it may be possible to use data from other nuclear explosions to add to our knowledge of the earth's deep interior.

#### GRADUATE EDUCATION FOR TEACHERS

At its meeting on May 28, the Advisory Board on Education passed a resolution recommending that colleges and universities establish programs of study leading to Masters' degrees either in education or in the teaching of mathematics and/or science, such programs and the courses comprising them being especially designed for secondary school teachers.

The various national scientific societies have been asked to endorse the resolution and help implement it. Thus far the American Chemical Society, the American Institute of Physics, the American Institute of Biological Sciences, and the Mathematical Association of America have taken action.

At the meeting of the Board on October 9, the members authorized widespread publicity of the resolution in scientific and educational journals. It was also agreed that the Board together with the American Association for the Advancement of Science, the American Council of Learned Societies, and the National Commission on Teacher Education and Professional Standards of the National Education Association would cosponsor a conference next June on subject-matter education for teachers.

# FOREIGN RESEARCH SCIENTISTS PROGRAM

The last group of awards under the Foreign Research Scientists Program, which has been supported by the International Cooperation Administration and administered by the Academy-Research Council, has now been made. Initiated in the spring of 1953, the program was designed to assist young scientists at the immediate post-doctoral level to pursue basic research in the United States at American universities and research laboratories. The Academy-Research Council has placed a total of 216 participants since the program began. The following table shows the total number of applications received and awards accepted for the entire period by country of origin.

The last group of awards made under the program is listed below. The name and country of origin of the recipients is given as well as the field and location of their research.

Table 1.—Applications received and awards granted and accepted under the Foreign Research Scientists Program.

Country	Applications received	Awards granted	Awards accepted
Austria.....	27	15	11
Belgium.....	14	10	9
Denmark.....	19	14	14
France.....	60	34	32
Germany.....	60	42	36
Greece.....	29	11	11
Italy.....	58	39	31
Netherlands...	22	15	14
Norway.....	45	20	19
Portugal.....	20	12	10
Turkey.....	19	13	10
United Kingdom...	33	25	19
Total.....	406	250	216

## From Austria:

Friedrich Brandtner, Pleistocene stratigraphy and palynology—Yale University, with Richard Foster Flint

Harald Nemenz, Physiological background of haplophily—University of Utah, with John D. Spikes

Georg Tisljar-Lentulis, Radiation biophysics—University of California at Berkeley, with Cornelius A. Tobias

## From Belgium:

Willy Boels, Pathological anatomy—Yale University, with Averill A. Liebow

Jean Christophe, Biochemistry, endocrinology—Harvard School of Public Health, with Jean Mayer

Jean Moutschen, Mutagenesis in mammals—Oak Ridge National Laboratory, with Alexander Hollaender

## From Denmark:

Preben Andersen, Cattle nutrition—Cornell University, with K. L. Turk

Thomas Pedersen, Agricultural engineering—Michigan State University, with Arthur W. Farrall

Ebbe Poulsen, Mathematics—University of California at Berkeley, with John L. Kelley and C. B. Morrey

## From France:

Odette Bagno, Colloid chemistry—Polytechnic Institute of Brooklyn, with Herbert Morawetz

Fernand Barnoud, Plant physiology—North Carolina State College, with Ernest Ball

Paul Cayre, Rubber chemistry—University of Akron, with Maurice Morton

Bernard Gauthé, Solid state physics—National Bureau of Standards, with Ladislaus L. Marton

Jacques Jousset-Dubien, Physical chemistry—Polytechnic Institute of Brooklyn, with Gerald Oster

Odile Thaler, Plant physiology—University of California at Los Angeles, with J. B. Biale

Pierre Trambouze, Chemical engineering—University of Minnesota, with Edgar L. Piret

## From Germany:

Horst Börner, Plant physiology—Boyce Thompson Institute for Plant Research, with George L. McNew

Gerd Gundlach, Biochemistry—Rockefeller Institute for Medical Research, with Stanford Moore

Roland Kammel, Metallurgy—Purdue University, with R. Schuhmann, Jr.

Heinrich Kroeger, Radiation biology—Oak Ridge National Laboratory, with Alexander Hollaender

Horst Prinzbach, Organic chemistry—Yale University, with William Doering

Walter Strohmeier, Physical chemistry—University of California at Berkeley, with Melvin Calvin

Wolfhart Zimmermann, Theoretical physics—Institute for Advanced Study, with Robert Oppenheimer

## From Greece:

Paraskevi Euthymiou, Nuclear physics—University of Illinois, with Peter Axel

John Kalovoulos, Soil science—North Carolina State College, with J. W. Fitts

Costas Krimbas, Genetics—Columbia University, with Th. Dobzhansky

Pericles Theocaris, Mechanical engineering—Illinois Institute of Technology, with A. J. Durelli

**From Italy:**

Renato Craveri, Antibiotics—Rutgers University, with Selman A. Waksman

Enrico di Martino, Biological control of citrus pests—University of California at Riverside, with C. P. Clausen

Ettore Fadiga, Cerebellar and brain stem physiology—University of Oregon Medical School, with John M. Brookhart

Paolo Favero, Physical chemistry—Duke University, with Walter Gordy

Fabio Ferrari, Theoretical physics—University of California at Berkeley, with Geoffrey Chew

Emmanuele Salvidio, Haematological cytochemistry—University of California Medical Center at Los Angeles, with William N. Valentine

Vladimiro Scatturin, Inorganic chemistry—Polytechnic Institute of Brooklyn, with I. Fankuchen

Francesco Serracchioli, Electronics—Ohio State University, with Robert A. Fouty

John Zacher, Algebra, theory of groups—Harvard University, with Richard Brauer

**From the Netherlands:**

Pieter Baayen, Abstract analysis, topological groups foundations—University of California at Berkeley, with Alfred Tarski

Johannes Dekker, Plant pathology—University of California at Berkeley, with Peter A. Ark

Hendrik de Stigter, Plant physiology—University of California at Davis, with H. B. Currier

Jakob Weits, Animal nutrition—Cornell University, with J. K. Loosli

**From Norway:**

Tor Brustad, Radiation biophysics—University of California at Berkeley, with Cornelius A. Tobias and Ann Birge

Kjell Eimhjellen, Microbial biochemistry—Stanford University (Pacific Grove), with C. B. van Niel

Johannes Moe, Structural engineering—Portland Cement Association, with Eivind Hognestad

Gotfred Uhlen, Plant nutrition and soil fertility—Cornell University, with R. Bradfield

**From Portugal:**

Tristão Mello de Sampaio, Cytogenetics—University of Illinois, with Marcus M. Rhoades

Miguel Mota, Cytogenetics—Oak Ridge National Laboratory, with Alexander Hollaender

**From Turkey:**

Ekrem Göksu, Petroleum geology—Stanford University, with Hubert G. Schenck

Kemal Kafali, Naval architecture—Massachusetts Institute of Technology, with George C. Manning

Mahmut Kayan, Mechanical engineering—Massachusetts Institute of Technology, with J. P. den Hartog

Celal Tüzün, Organic chemistry—Polytechnic Institute of Brooklyn, with C. G. Overberger

**UNITED STATES NATIONAL COMMISSION  
FOR UNESCO SIXTH NATIONAL  
CONFERENCE**

The U. S. National Commission for Unesco convened the Sixth National Conference in San Francisco, November 6-9, and chose as the theme of the Conference "Asia and the United States: What the American Citizen Can Do to Promote Mutual Understanding and Cooperation." Hans T. Clarke of Yale University, a member of the U. S. National Commission for Unesco representing the National Academy of Sciences, and Wallace W. Atwood, Jr., Director of the Office of International Relations, represented the Academy-Research Council at the Conference.

The Academy-Research Council was one of six institutions responsible for planning the technical sessions of the Conference program. With the cooperation of the American Association for the Advancement of Science and the Social Science Research Council, the Academy-Research Council planned the program for Section C on "Science and Technology in Asia and Their Social Impact" and organized the three Work Groups on Asian-American science cooperation in South, Southeast, and East Asian countries. William L. Thomas, Jr., Professor of Geography, University of California at Riverside, handled program arrangements for the Academy-Research Council and served as rapporteur for Section C.

Harrison Brown, Professor of Geochemistry at California Institute of Technology, served as chairman of Work Group C-1; Harold J. Coolidge, Executive Director of the Pacific Science Board, was chairman of Work Group C-2; and Hubert G. Schenck, Professor of Geology at Stanford University, occupied the chair for Work Group C-3.

At the fourth plenary session on Saturday, November 9, a report representing a compilation of findings by Section C and its Work Groups was made to the Conference. A panel of leaders experienced in public affairs then evaluated all Section reports from the viewpoint of their usefulness in the promotion of Asian-American understanding and cooperation.



## INTERNATIONAL INSTITUTE OF REFRIGERATION

The U. S. National Committee for the International Institute of Refrigeration (IIR) held its inaugural meeting at the Academy-Research Council building on September 20. The Chairman, Richard C. Jordan, outlined the establishment of the Committee and the admission of the Academy-Research Council to membership in the IIR (see NEWS REPORT, Vol. VI, pp. 96-97, 1956). F. G. Brickwedde reported on the activities of the Finance Subcommittee and its program for obtaining funds to support the new Committee's activities.

The Committee adopted a travel policy for Committee members attending various meetings of the IIR, its executive bodies, and Commissions overseas, as well as travel within the United States. Several nominations for membership on the nine Commissions of the IIR were made, and plans for the 11th International Conference on Refrigeration to be held in 1963 were discussed. The Committee also selected the Cryogenic Engineering Conference to be represented in its membership.

The present officers of the Committee in addition to the Chairman, Dr. Jordan, are H. C. Diehl, Vice Chairman, and W. T. Pentzer, Secretary. The current membership of the Committee and the organizations represented are as follows:

### Air-Conditioning and Refrigeration Institute

JOHN E. DUBE, Alco Valve Company

### American Institute of Biological Sciences

FRANK P. CULLINAN, U. S. Department of Agriculture

### American Physical Society

HENRY A. BOORSE, Columbia University

### American Society of Heating and Air-Conditioning Engineers

A. J. HESS, Hess-Greiner & Pollard

### American Society of Mechanical Engineers

CARL F. KAYAN, Columbia University

### American Society of Refrigerating Engineers

RICHARD C. JORDAN, University of Minnesota

### Refrigeration Research Foundation

H. C. DIEHL, Director and Secretary of the Foundation

### United States Department of Agriculture

GUIDO E. HILBERT, Assistant Administrator, Agricultural Research Service

### United States Department of Commerce

PAUL R. ACHENBACH, Chief, Air Conditioning, Heating and Refrigeration Section, National Bureau of Standards

### United States Department of Interior

CHARLES BUTLER, Chief of Technological Section, Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service

### Members-at-large

M. J. COPLEY, U. S. Department of Agriculture

WALTER A. GRANT, Carrier Corporation

JOHN N. KELLEY, Fruit Dispatch Company

### Ex-Officio Members (voting)

FERDINAND G. BRICKWEDDE, Vice-President of IIR Commission 1—Scientific problems of low temperature physics and thermodynamics; industries of the very low temperatures and of the rare gases

B. H. JENNINGS, Vice-President of IIR Commission 6—Applications of refrigeration excluding foodstuffs and agricultural produce

W. T. PENTZER, Vice President of IIR Technical Board and Vice-President of IIR Commission 4—Applications of refrigeration to foodstuffs and agricultural produce

### Ex-Officio Members (non-voting)

E. C. BAIN, Chairman, Division of Engineering and Industrial Research

L. A. MAYNARD, Chairman, Division of Biology and Agriculture

BRIAN O'BRIEN, Chairman, Division of Physical Sciences

FREDERICK D. ROSSINI, Chairman, Division of Chemistry and Chemical Technology

WALLACE W. ATWOOD, JR., Director, Office of International Relations

S. C. COLLINS of the Massachusetts Institute of Technology and Byron E. Short from the University of Texas, members of the IIR Commissions 1 and 2, also attended the first meeting of the Committee.

## AGRICULTURAL RESEARCH INSTITUTE

The sixth annual meeting of the Agricultural Research Institute, held at the Academy-Research Council building on October 14 and 15, applied itself to two fundamental and seemingly contradictory problems facing agriculture today. A panel of experts from the President's Commission on Increased Industrial Use of Agricultural Products considered ways to utilize current farm surpluses. Other panels discussed the employment of basic research as a means of increasing acreage yields beyond present levels.



The paradox was explained as follows: The fundamental concern of the Agricultural Research Institute is to help ensure the continuing prosperity of a soundly based agricultural and industrial economy through basic and applied research. Recognizing that certain agricultural surpluses exist today, the Institute must also recognize that this condition is a temporary phenomenon. While our national population is rising, our arable acreage is continually diminishing. There is also the ever-present possibility of a nationwide drought, similar to others in the not-too-distant past.

For those reasons, it is essential to seek every means to sustain current production by developing the industrial use of farm products and to forestall actual agricultural deficits in the foreseeable future by stimulating research at every level.

A very new look at a very old branch of agricultural research was a feature of the Tuesday morning session at which the panelists explored the developing possibilities of agroclimatology as an agricultural science. The discussions covered personnel and facility requirements for agroclimatology research on analysis of agroclimatic data, basic concepts for crop-climate studies, data requirements for analysis of climatic effect on crop production, requirements for analysis of water exchange between soil, plant and air, and the role of climatologists in agricultural experiment stations.

Panel participants and areas of discussions were as follows:

#### **Panel on Utilization Research:**

WHEELER McMILLEN, Council for Agricultural and Chemurgic Research, *Moderator*

PAUL E. HADLICK, Consultant, President's Commission on Increased Industrial Use of Agricultural Products

GEORGE W. IRVING, JR., U. S. Department of Agriculture

FRANK J. WELCH, University of Kentucky

#### **Panel on Basic Research:**

M. T. GOEBEL, E. I. du Pont de Nemours and Co., Inc., *Presiding*

J. J. THOMPSON, Chas. Pfizer and Co.

MARIO SCALERA, American Cyanamid Company

STERLING B. HENDRICKS, U. S. Department of Agriculture

#### **Panel on Basic Research in Animal Sciences:**

W. A. GLISTA, Chas. M. Cox Company, *Moderator*

DAMON CATRON, Iowa State College

J. THOMAS REID, Cornell University

E. P. SINGSEN, University of Connecticut

#### **Panel on Agroclimatology:**

M. H. HALSTEAD, U. S. Navy Electronics Laboratory, *Chairman*

H. C. S. THOM, U. S. Weather Bureau

F. W. WENT, California Institute of Technology

C. H. M. VAN BAVEL, U. S. Department of Agriculture

ROBERT H. SHAW, Iowa State College

P. E. WAGGONER, Connecticut Agricultural Experiment Station

M. M. KELSO, Montana State Agricultural Experiment Station

The new officers elected by the Agricultural Research Institute were C. L. Rumberger, H. J. Heinz Company, *President*; Burt Johnson, National Cotton Council of America, *Vice President*; and Charles S. Mahoney, National Cannery Association, *Secretary*.

### **CONFERENCE ON ELECTRICAL INSULATION**

The Conference on Electrical Insulation held its 26th annual meeting at Pocono Manor Inn, Pocono Manor, Pa., October 21-23, with 224 in attendance.

Fifteen technical papers were presented at the five technical sessions, and round-table sessions were held on 1) dielectric properties of treated metal surfaces applied to aluminum magnet wire, 2) surface contamination of dielectrics, 3) electrical breakdown in dielectrics, 4) high voltage cable developments, and 5) a discussion of revision of part of the American Institute of Electrical Engineers (AIEE) Code, dealing with general principles upon which temperature limits are based in the rating of electrical equipment.

William A. Del Mar of the Habirshaw Cable and Wire Division of Phelps Dodge Copper Products, presented the third Whitehead Memorial Lecture on "Problems Relating to High Voltage Cables." The main speaker at the Conference banquet, W. B. Kouwenhoven, chose as his subject, "Effects of Electric Shock." Professor Kouwenhoven is the retired dean of the School of Electrical Engineering of the

Johns Hopkins University and current Lecturer in Surgery in the University's Medical School. His talk included motion pictures of a recent therapy, the application of electrical shock to cause defibrillation of the human heart during illness, accidents, and surgical procedures. Defibrillation is the restoration of effective heart action.

The following officers were nominated for 1958: E. R. Thomas, Consolidated Edison Company of New York, *Chairman*; J. D. Hoffman, National Bureau of Standards, *Vice Chairman*; and W. McMahon, Bell Telephone Laboratories, *Secretary*.

Members of the Conference accepted an invitation to hold their next meeting in Pittsburgh in October 1958 and to visit the Research Laboratories of Westinghouse Electric Company in East Pittsburgh.

#### VISITS OF SOVIET PHYSICIANS

In recent weeks the Division of Medical Sciences has been host to two delegations of distinguished Soviet medical scientists, visiting the United States for approximately one month each on exchange missions arranged through the U. S. Department of State.

The first group, whose itinerary was planned by the U. S. Public Health Service, made their visit on October 15. Following an informal discussion of the activities and organization of the Academy-Research Council with S. Douglas Cornell, Wallace W. Atwood, Jr., and R. Keith Cannan, they met at tea with staff members representing programs related to medicine. The delegation was as follows:

NIKOLAI N. BLOKHIN, Institute of Experimental Pathology and Therapy of Cancer, U.S.S.R. Academy of Medical Sciences

IVAN L. BOGDANOV, Institute of Infectious Diseases at Kiev

SERGEI V. KURASHOV, Minister of Public Health, Russian Soviet Federated Socialist Republic

SEMIEN A. SARKISOV, Vice President of the U.S.S.R. Academy of Medical Sciences and Director of the Institute of the Brain

GRIGORIY V. VYGODCHIKOV, Institute of Epidemiology and Microbiology, U.S.S.R. Academy of Medical Sciences

The second delegation, composed of women physicians, visited laboratories and other points of interest in the Washington-

Baltimore area during the week of October 27, in the course of an exchange tour sponsored by the Rockefeller Foundation. Arrangements for the Washington visit were made by the Division, which entertained the group at a reception on November 1. The members of this group were:

N. A. DZHAVAKHASHVILI, Institute of Experimental Morphology, Georgian Academy of Sciences

M. N. FATEYVA, Institute of Labor Hygiene and Occupational Disease, U.S.S.R. Academy of Medical Sciences

N. I. PEREVODCHIKOVA, Institute of Experimental Pathology and Cancer Therapy, U.S.S.R. Academy of Medical Sciences

A. M. SHISHOVA, First Moscow Medical Institute

A. K. SHUBLADZE, Ivanov Institute of Virology, U.S.S.R. Academy of Medical Sciences

E. A. VASYUKOVA, Institute of Experimental Endocrinology, U.S.S.R. Ministry of Health

An exchange delegation of American men, chosen by the U. S. Public Health Service, had visited the U.S.S.R. prior to the arrival of the Soviet visitors. Arrangements are now being made for a party of American women physicians, to be selected by the Academy-Research Council, to visit Russia early next year.

#### BUILDING RESEARCH ADVISORY BOARD NEW STUDIES

The Building Research Advisory Board is undertaking six new studies for the Federal Housing Administration. Three of these studies will deal with ramifications of slab-on-ground construction. One will seek to determine the effectiveness of concrete admixtures as protection against moisture penetration; another will attempt to determine the need for and location of moisture barriers for slab-on-ground construction above grade level; and the third will attempt to define criteria for proper design and construction of slabs to insure structural soundness. The other studies will be on 1) materials and methods of installation for residential building sewers; 2) physical and thermal properties of products used for heating and air-conditioning ducts; and 3) the amounts of preservative-treated lumber necessary for termite control and the effect of vapor barriers between foundation and sill plate on prevention of decay.

## COMMITTEE ON HEARING AND BIO-ACOUSTICS

The fifth annual meeting of the Armed Forces-National Research Council Committee on Hearing and Bio-Acoustics was held in the Academy-Research Council building on October 30 and 31 with about 100 committee members and guests in attendance.

The highlight of the meeting was the report by Hallowell Davis, Executive Secretary of the Committee, on the auditory effects of high intensity noise encountered in the operation of jet aircraft from aircraft carriers. The general conclusion from this study is that detected hearing losses among naval personnel engaged in flight deck operations are not as prevalent or as severe as was anticipated. However, since noise levels will probably continue to increase, the requirement for careful monitoring of the auditory effects of noise exposure will continue. W. D. Neff of the University of Chicago was elected chairman of the Committee for a two-year term to succeed Clifford P. Phoebus, Captain, Medical Corps, U. S. Navy.

## NINTH PACIFIC SCIENCE CONGRESS

The Ninth Pacific Science Congress of the Pacific Science Association is now in session at Bangkok, Thailand. The Congress started on November 18 and will terminate on December 9. The aims of the Association are *a*) to initiate and promote cooperation in the study of scientific problems relating to the Pacific region, particularly those affecting the prosperity and well-being of Pacific peoples, and *b*) to strengthen the bonds of peace among Pacific peoples by promoting a feeling of brotherhood among scientists of all the Pacific countries. The Pacific Science Congresses are the principal means by which the Association seeks to attain its objectives.

The Academy-Research Council as the United States representative in the Association appointed a twenty-five man delegation to meet with the scientific representatives from the 35 other nations participating in the Congress. The U. S. Department of State appointed an official United States

delegation to the meeting. The following list of Academy-Research Council delegates includes those appointed by the Department of State:

- \*KNOWLES A. RYERSON, University of California at Berkeley, *Chairman*
- H. OTLEY BEYER, University of the Philippines
- HAROLD J. COOLIDGE, Academy-Research Council
- H. G. DEIGNAN, U. S. National Museum
- FRED R. EGGAN, University of Chicago
- \*ROBERT D. FLETCHER, Andrews Air Force Base
- \*F. R. FOSBERG, U. S. Geological Survey
- W. McD. HAMMON, University of Pittsburgh
- \*WILLIAM D. JOHNSTON, U. S. Geological Survey
- \*L. A. MAYNARD, Academy-Research Council
- \*KARL F. MEYER, University of California Medical Center
- ROBERT C. MILLER, California Academy of Sciences
- \*G. P. MURDOCK, Yale University
- KARL J. PELZER, Yale University
- \*CYRIL E. PEMBERTON, Hawaiian Sugar Planters' Association Experiment Station
- LOUIS O. QUAM, U. S. Office of Naval Research
- \*ROGER R. REVELLE, Scripps Institution of Oceanography
- LAURISTON SHARP, Cornell University
- R. H. SIMPSON, U. S. Weather Bureau
- \*ATHELSTAN F. SPILHAUS, University of Minnesota
- \*ALEXANDER SPOEHR, Bernice P. Bishop Museum
- F. J. STARE, Harvard University
- \*R. EARL STORIE, University of California at Berkeley
- IRENE B. TAEUBER, Princeton University
- ALBERT L. TESTER, U. S. Department of the Interior
- R. L. USINGER, University of California at Berkeley
- LEONARD S. WILSON, U. S. Department of the Army

\* United States Delegate to the Congress.

## NATIONAL SCIENCE FOUNDATION FELLOWSHIPS

The Fellowship Office of the Academy-Research Council will again assist the National Science Foundation with its seventh fellowship program by receiving and evaluating fellowship applications for the 1958-59 academic year. The Foundation plans to award approximately 850 graduate and 85 postdoctoral fellowships in the mathematical, physical, medical and biological fields, in engineering, anthropology (except clinical) and geography; and in certain interdisciplinary fields and fields of convergence between the natural and social sciences. These fellowships are open only to citizens of the United States.

Graduate fellowships are available to those who are working toward the masters' or doctoral degrees. College seniors who expect to receive a baccalaureate degree during the 1957-58 academic year are also eligible. Postdoctoral fellowships are available to individuals who have a Ph.D. degree in one of the fields listed above or who have had research training and experience equivalent to such a degree. Holders of an M.D., D.D.S., or D.V.M. degree are also eligible provided they can present an acceptable plan of study and research.

The annual stipends for graduate fellows are as follows: \$1,600 for the first year; \$1,800 for the intermediate year; and \$2,000 for the terminal year. The annual stipend for postdoctoral fellows is \$3,800. Dependency allowances will be made to married fellows; and tuition, laboratory fees, and limited travel allowances will also be provided.

Descriptive brochures and application forms may be secured from the Fellowship Office of the Academy-Research Council. Applications for regular postdoctoral fellowships must be received by December 23, 1957; and applications for graduate fellowships must be received by January 3, 1958. Awards will be announced by the National Science Foundation on March 15, 1958.

#### ADHESIVES AND SEALANTS IN BUILDING

The Building Research Institute is conducting a research correlation conference on "Adhesives and Sealants in Building" on December 4 and 5 at the Shoreham Hotel in Washington, D. C. The two-day meeting will be divided into five sessions dealing with the following subjects: 1) Sealing joints in the building exterior (traditional materials and metal curtain walls); 2) adhesives for the building interior; 3) adhesives for structural materials and components (cementitious materials and lumber products, and sandwich panels); 4) future of adhesives and sealants in building. In addition to the formal presentation of papers there will be panel discussions on each major topic.

The following Building Research Insti-

tute members served on the Planning Committee for the conference:

CLAYTON S. MYERS, Bakelite Company, *Chairman*  
G. W. BATTAGLIA, National Starch Products, Inc.  
ALBERT G. H. DIETZ, Massachusetts Institute of Technology  
WILLIAM J. FINNORN, Timber Engineering Company  
FRANCIS L. FRYBERGH, Skidmore, Owings & Merrill  
DANIEL GOEKE, Larsen Products Sales Corporation  
R. S. GRIFFIN, E. I. du Pont de Nemours and Co., Inc.  
FRANK J. HANRAHAN, American Institute of Timber Construction  
R. L. HULDEBRAN, United States Plywood Corporation  
LESLIE M. JACKSON, Tremco Manufacturing Company  
GEORGE W. KOEHN, Armstrong Cork Company  
WAYNE F. KOPPEL, Architectural Consultant, Basking Ridge, N. J.  
J. R. PANEK, Thiokol Chemical Corporation  
JACK M. ROEHM, The Kawneer Company  
GEORGE J. SCHULTE, Minnesota Mining and Manufacturing Co.  
FRANK H. WETZEL, Hercules Powder Company

#### POSTDOCTORAL RESIDENT RESEARCH ASSOCIATESHIPS

The Academy-Research Council has announced that the programs of postdoctoral resident research associateships again will be offered for the 1958-59 academic year at the Argonne National Laboratory in Lemont, Ill., the National Bureau of Standards laboratories in Washington, D. C., and Denver, Colo.; at the Naval Research Laboratory in Washington, D. C.; and at the Oak Ridge National Laboratory in Oak Ridge, Tenn.

These postdoctoral resident associateships have been established to provide young scientists of unusual ability and promise an opportunity for advanced training in basic research in a variety of fields. The most modern facilities are available in the general areas of the biological, physical, and mathematical sciences. In addition, research in visual psychophysics and engineering psychology is also available.

Applicants must be citizens of the United States and have training in one of the listed fields equivalent to that represented by the Ph.D. or Sc.D. degree. They must have demonstrated superior ability for

creative research. Stipends for these associateships are \$7,035 a year. Applications must be filed at the Fellowship Office on or before January 13, 1958. Awards will be announced about April 1, 1958.

Descriptive brochures and application materials may be obtained from the Fellowship Office of the Academy-Research Council.

#### PAN AMERICAN INSTITUTE OF GEOGRAPHY AND HISTORY

A joint meeting of the Committees on Geography and Cartography was held at the Academy-Research Council on September 11. These Committees were established a little over a year ago to assist the Department of State in effecting United States participation in the Commissions on Geography and Cartography of the Pan American Institute of Geography and History (PAIGH).

At the joint meeting, Robert Randall, Acting Chairman of the Commission on Cartography, outlined plans for the First Cuban Symposium on Natural Resources and the Eighth Pan American Consultation on Cartography. These two meetings will be held consecutively in Havana in February of 1958 under the auspices of the Cuban Government. Arch C. Gerlach, the United States member of the Directing Council of PAIGH, reported on the June meeting of the Council held in Rio de Janeiro.

Arthur Sweet, member-at-large and secretary of the Committee on Cartography, and Andre C. Simonpietri, Associate Director of the Office of International Relations, will go to Havana early in December to work with authorities of the Cuban Government on advance preparations for the two meetings.

#### RESEARCH ASSOCIATESHIPS IN MATHEMATICS

The Committee on Mathematics, Advisory to the Office of Naval Research (ONR), will again assist ONR by evaluating applications received for a number of postdoctoral research associateships in pure mathematics offered for the academic year 1958-59 through contracts with ONR

at selected universities. Upon the recommendation of the Committee, the following universities have been invited to participate in this program.

Brown University  
California Institute of Technology  
Columbia University  
Cornell University  
University of Illinois  
Johns Hopkins University  
University of Michigan  
Northwestern University  
University of Notre Dame  
Ohio State University  
Purdue University  
University of Virginia  
University of Washington  
Yale University

Appointments will provide a salary of \$5,000 for the academic year and an allowance for incidental expenses, including travel. Applications for 1958-59 must be submitted by January 15, 1958, and awards will be announced in April. Application forms and further information may be obtained from Arthur Grad, Mathematics Branch, Office of Naval Research, Washington 25, D. C.

#### STAFF APPOINTMENTS

**Walter M. Bejuki** was appointed Assistant Director of the Prevention of Deterioration Center effective October 1. Dr. Bejuki received his D.Sc. degree in biology from the Philadelphia College of Pharmacy and Science in 1950 and has been a member of the staff of the Center since February 1955 (*see NEWS REPORT*, Vol. V, No. 2, p. 30).

The Committee on Meteorology announces the appointment of **John R. Sievers** as Executive Secretary for the Committee. Mr. Sievers is a graduate of the University of Chicago and for the past five years has been associated with the Cloud Physics Research Laboratory of the University of Chicago.

The U. S. National Committee for the International Geophysical Year (IGY) announces the following appointments to the IGY staff: **James Henley Morgan**, Special Assistant to the Executive Director and Head of the International Section; **Charles W. Thomas**, Head of the Arctic Section;



**John C. Truesdale, Jr.**, Assistant Director, Office of Information; **Phillip W. Mange**, Assistant Program Officer; **George A. Baker**, **Albert N. Bove**, and **William H. Allen**, Technical Writers; and **Leon N. Lazarian**, Technical Photographer.

**Richard C. Vetter** has been appointed Executive Secretary of the newly formed Committee on Oceanography under the chairmanship of Harrison Brown, California Institute of Technology. For the past six years Mr. Vetter has been an active member of the Geophysics Branch of the Office of Naval Research and is now on leave of absence. He received his M.A. degree in physical oceanography from the Scripps Institution of Oceanography, University of California, in February 1951. Just before coming to Washington, Mr. Vetter spent several months teaching in Japan.

The Division of Engineering and Industrial Research has announced the appointment of **W. J. Harris, Jr.**, as Executive Director of the Materials Advisory Board to succeed **Verne H. Schnee** who died of heart failure on September 22. Mr. Schnee served the Academy-Research Council in three major positions in the past 15 years. He headed the Materials Division of the War Metallurgy Committee during World War II; he next served as chairman of the Committee on Ship Construction; and at his death had been serving since 1950 as Executive Director of the Materials Advisory Board.

Dr. Harris received his Sc.D. degree from the Massachusetts Institute of Technology in 1948 and first came to the Board in 1951 as its Executive Secretary. From 1954-57, he was Assistant to the Director of the Battelle Memorial Institute.

## RECORD OF MEETINGS

### September

- 3-7 Symposium on Photochemical Storage of Energy, *Dedham, Mass.*
- 4 Agricultural Board, Executive Committee, *Chicago*
- 5 Panel on Beryllium, Geology and Beneficiation Group, *Denver*
- 9 Subcommittee on Water Supply
- 10 Committee on Industrial Chemistry, *New York City*
- Division of Chemistry and Chemical Technology, Committee on Nomenclature, *New York City*
- Agricultural Research Institute, Projects and Proposals Committee
- Federal Construction Council, Task Group on Underground Pipe Installations and Systems
- 11 Committees on Cartography and on Geography, Advisory to the Department of State, Joint Meeting
- 12 Subcommittee on Thermal Factors in Environment
- 14 Committee on Mathematics, Advisory to Office of Naval Research, *Princeton, N. J.*
- 16 Technical Studies Advisory Committee for Federal Housing Administration, Soils Subcommittee
- Conference on Oceanography

### September

- 16-18 Mine Advisory Committee
- 16-20 Orientation meeting for Antarctic Scientists, *Davisville, R. I.*
- 17-18 Technical Studies Advisory Committee for Federal Housing Administration
- Building Research Institute, Plastics Study Group, *St. Louis*
- 18 Study Group on Disposal and Dispersal of Radioactive Wastes
- Panel on Beryllium, Physical Metallurgy Group, *New York City*
- 19 Committee on Protein Malnutrition, *New York City*
- Ad hoc Committee to Evaluate Contract Proposals for Operation of U. S. Army Ionizing Radiation Center
- 20 Advisory Board on Education
- USA National Committee, International Institute of Refrigeration.
- Urban Research Conference
- 21 USA National Committee, International Union Against Cancer
- 22-23 Institute of Laboratory Animal Resources
- 23 Building Research Institute, Finance Committee
- Building Research Institute, Membership Planning Committee



## September

- 23-25 AASHO Road Test, Panel on Materials and Construction  
Committee on Meteorology, *Cambridge and Woods Hole, Mass.*
- 24 Building Research Institute, Board of Governors
- 25 International Conference on Scientific Information, Program Committee  
Special Subcommittee of Ad hoc Advisory Committee for Asphalt Research and Development  
Building Research Institute, Subcommittee for Seventh Annual Meeting
- 26 Subcommittee on Radiation Preservation, *Chicago*  
Federal Construction Council, Review Committee on Plumbing Research
- 26-27 Committee on Economics of Motor Vehicle Size and Weight
- 27 Committee on Naval Medical Research, *Bethesda, Md.*
- 28 National Science Foundation Postdoctoral Fellowship Committees
- 29 National Science Foundation Postdoctoral Fellowship Board
- 30-Oct. 5 International Conference on Rocket and Earth Satellite Programs

## October

- 1 Building Research Institute, Programs Committee
- 3 Building Research Advisory Board, Executive Committee
- 4 Committee on Sanitary Engineering and Environment
- 5 Committee on Photogrammetry and Aerial Surveys, *Lafayette, Ind.*  
National Science Foundation Senior Postdoctoral Fellowship Committees
- 6 Division of Biology and Agriculture, Executive Committee  
National Science Foundation Senior Postdoctoral Fellowship Board
- 6-8 Food Protection Committee, *Davis, Calif.*
- 8-9 Materials Advisory Board
- 9 Committee on Chemistry of Coal, Organizing Group, *Pittsburgh*  
Food Technology Subcommittee, *Davis, Calif.*  
Advisory Board on Education
- 9-11 Conference on Measurements and Standards of Radioactivity, *Easton, Md.*
- 10 Federal Construction Council, Task Group on Cathodic Protection as Applied to Underground Metal Structures
- 10-11 Conference on Advances in the Chemistry of Naturally Occurring Organic Sulphur Compounds, *Natick, Mass.*
- 11 Subcommittee on the Nervous System
- 12 Council of the Academy  
Ad hoc Conference on Deterioration of Parenteral Solutions  
Committee on Applications of Mathematics, *New York City*

## October

- 13 National Academy of Sciences—National Research Council, Governing Board  
Agricultural Board  
Agricultural Research Institute, Governing Board  
Agricultural Research Institute, Projects and Proposals Committee
- 14 Building Research Institute, Plumbing Research Committee  
Federal Construction Council, Task Group on Thermal Insulation and Waterproofing Materials for Hot and Refrigerated Piping  
Office of Critical Tables, Executive Committee
- 14-15 Committee on Fire Research, *Battle Creek, Mich.*  
Agricultural Research Institute
- 14-16 Panel on High Strength Steel, *Los Angeles*
- 15 Committee on Agricultural Meteorology and Climatology  
Conference on Sarcoidosis  
Committee on Soil-Crop-Water Relationships
- 17 Committee on Amino Acids
- 21 Panel on Transfusion Problems
- 21-23 Conference on Electrical Insulation, Annual Meeting, *Pocono Manor, Pa.*
- 22 Subcommittee on Blood and Related Problems  
Building Research Institute, Subcommittee for Seventh Annual Meeting
- 23 Panel on Plasma  
Subcommittee on Cereal and Baked Products, *Chicago*  
Titanium Sheet Rolling Panel, Sub-panel on Heat Treatment
- 24 Office of Scientific Personnel, Advisory Committee  
Prevention of Deterioration Center, Services Technical Committee
- 24-25 Titanium Sheet Rolling Panel
- 25 Subcommittee on Radiobiology  
Subcommittee on Oncology
- 26 Committee on Soils-Calcium-Chloride Roads, *Greensboro, N. C.*  
Committee on International Exchange of Persons
- 28 Advisory Committee on Civil Defense
- 29 Prosthetics Research Board, *Los Angeles*  
Panel on Beryllium, Physical Metallurgy Group, *New York City*
- 29-30 American Geophysical Union, Northwest Pacific Regional Meeting, *Pullman, Wash.*  
Armed Forces—National Research Council Committee on Hearing and Bio-Acoustics
- 31 Committee on Dietary Allowances  
Committee on Cereals  
Food and Nutrition Board, Executive Committee  
Subcommittee on Nuclear Geophysics  
Subcommittee on Anesthesia

## NEW PUBLICATIONS

- Brown, Ellen. *Studies of Circulation and Surface Temperature of Amputation Stumps*. Prosthetics Research Board, National Research Council. Berkeley, Calif., Lower-Extremity Amputee Research-Project, Institute of Engineering Research, University of California; Berkeley, Calif., Department of Engineering; San Francisco, Calif., School of Medicine, 1957. 94 p. and 43 figures.
- Moul, Edwin T. *Preliminary Report on the Flora of Onotoa Atoll, Gilbert Islands*. Washington, NAS-NRC, Pacific Science Board, 1957. (Scientific Investigations in Micronesia. SIM Report No. 24.) 48 p.
- National Research Council. *National Research Council of the National Academy of Sciences. Organization and Members, 1956-1957*. Washington, 1956. 111 p.
- National Research Council. Division of Mathematics. *Visiting Foreign Mathematicians . . .* Washington, 1957. 7 p.
- National Research Council. Highway Research Board. *Bituminous Paving Mixtures . . .* Washington, 1957. (NAS-NRC Publication 499. Highway Research Board Bulletin 160.) 122 p., illus. \$2.40.
- National Research Council. Highway Research Board. *Economic Impact of Highway Improvement. Conference Proceedings, March 18-19, 1957*. Washington, 1957. (NAS-NRC Publication 541. Highway Research Board Special Report 28.) 88 p., illus. \$2.80.
- National Research Council. Highway Research Board. *Highway Needs Studies, 1957, a Symposium . . .* Washington, 1957. (NAS-NRC Publication 497. Highway Research Board Bulletin 158.) 133 p., illus. \$2.80.
- National Research Council. Highway Research Board. *Investigating and Forecasting Traffic Accidents . . .* Washington, 1957. (NAS-NRC Publication 521. Highway Research Board Bulletin 161.) 54 p., illus. \$1.20.
- National Research Council. Pacific Science Board. *Ten Years of Pacific Science Board Field Programs, 1947-1956*. Washington, 1957. 16 p., illus.
- Spector, William S., ed. *Handbook of Toxicology. Volume II, Antibiotics. Compiled from the Literature by John N. Porter and Gilbert C. DeMello. Prepared under the Direction of the Committee on the Handbook of Biological Data, Division of Biology and Agriculture, The National Academy of Sciences, The National Research Council*. Wright-Patterson Air Force Base, Ohio, Wright Air Development Center, Air Research and Development Command, United States Air Force, 1957. (WADC Technical Report 55-16, Volume II.) 264 p. (Note: Trade edition of this title was previously listed in the *News Report* and is available from W. B. Saunders Company, Philadelphia, for \$6.00.)
- Toverud, Kirsten Utheim, et al. *Maternal Nutrition and Child Health, an Interpretative Review*. Washington, NAS-NRC, Food and Nutrition Board, 1957. (National Research Council Bulletin 123. November 1950, *Reprinted* 1957.) \$2.00.
- Williams, Morgan L. *Investigation of Fractured Steel Plates Removed from Welded Ships . . . Department of the Navy, Bureau of Ships Index No. NS-011-048 Transmitted through Committee on Ship Steel, Division of Engineering and Industrial Research, NAS-NRC, under Department of the Navy, Bureau of Ships Contract NObs-72046, Buships Index No. NS-731-036*. Washington, NAS-NRC, 1957. 108 p., illus. (Serial No. NBS-6, Sixth Progress Report of Project SR-106 to the Ship Structure Committee.)

### Notice of Academy Meetings

#### NATIONAL ACADEMY OF SCIENCES

Annual Meeting, Washington, D. C., April 28-30, 1958

#### NATIONAL ACADEMY OF SCIENCES—NATIONAL RESEARCH COUNCIL

Governing Board, Washington, D. C., December 8, 1957

Governing Board, Washington, D. C., February 9, 1958

Governing Board, Washington, D. C., April 27, 1958

Governing Board, Washington, D. C., June 15, 1958

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